



## PHENIX TOF.W GAS SYSTEM OPERATION PROCEDURE

### PHENIX Procedure No. PP-2.5.3.8-06

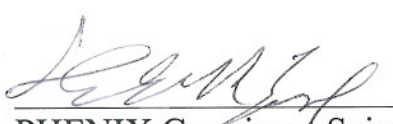
Revision: C

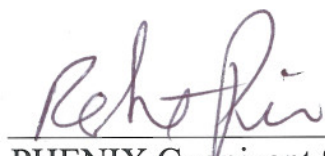
Date: 1/25/2013


#### Hand Processed Changes

- | <u>HPC No.</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <u>Date</u> | <u>Page Nos.</u> | <u>Initials</u> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------|-----------------|
| <ul style="list-style-type: none"><li>• <i>Typo: Section 3.1: "PHENIX Local Emergency Plan, RHIC-OPM 3.16" should be written as "Emergency Procedures for the STAR Detector and the 1008 Complex, C-A-OPM 3.16"</i></li><li>• <i>Typo: Under Section 6 Procedure: The numbering of 4.2, 4.2.1, 4.2.2, etc., should be written as 6.2, 6.2.1, 6.2.2, etc., and similar corrections should be done to the numbering of 4.3, 4.3.1, etc.</i></li><li>• <i>Suggestion: This procedure contains two Purpose and Scope (1.0 &amp; 7.0) and two Procedures (6.0 &amp; 8.0). It would be better to a) separate them into two separate documents, or b) combine them in such a way as to have only one Purpose and Scope, and one Procedure.</i></li><li>• <i>Suggestion: Sections 9.0 &amp; 9.1 should be part of 8.0 Procedure. In addition, there are two 9.1.</i></li></ul> |             |                  |                 |

#### Approvals

 1/29/13  
PHENIX Cognizant Scientist/ Date  
Engineer/Activity Manager

 1/31/13  
PHENIX Cognizant Scientist/ Date  
Engineer/Activity Manager

 1-30-13  
PHENIX Cognizant Scientist/ Date  
Engineer/Activity Manager

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### **Approvals**

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Engineer/Activity Manager

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Engineer/Activity Manager

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**REVISION CONTROL SHEET**

<b>LETTER</b>	<b>DESCRIPTION</b>	<b>DATE</b>	<b>AUTHOR</b>	<b>APPROVED BY</b>	<b>CURRENT OVERSIGHT</b>
A	First Issue	12-1-06	R. Pisani/ Leonid Kotchenda	R.Pisani, D. Lynch, A. Etkin, E. O'Brien	R. Pisani
B	Reviewed and found to require no procedural changes. Added note concerning use of 5% SF6 to end of section 7.0 (Approved by CAD ESRC at Nov. 2009 annual PHENIX Safety Review). Changed attachment 2 from list of responsible persons to web link to PHENIX experts.	1/12/2010	(Same)	R. Pisani, D. Lynch, P. Giannotti	R. Pisani
C	Reviewed and found to be OK as is	1/25/2013	D. Lynch	P.Giannotti, D. Lynch, R. Pisani	R. Pisani

## **1.0 Purpose and Scope**

The goal of this procedure is to instruct PHENIX personnel in the correct procedure for starting the TOF.W gas system and for purging the TOF.W with dry Nitrogen prior to the introduction of R134A+5%isobutane Mixture.

This procedure contains the steps necessary to start the TOF.W gas system from a fully shutdown state and to purge the TOF.W detectors and secondary systems with dry Nitrogen. In this operation, Nitrogen gas is routed from a tank that resides on the gas pad outside of the PHENIX Mixing House (MH), through all portions of the TOF gas system and then into the TOF.W itself. The gas from the TOF.W is vented to the Vent line outside MH. The gas flow will be about 1 liter per minute (LPM).

The primary purpose of purging the TOF.W with dry Nitrogen is to reduce the Oxygen and Water content below 10 ppm. At the end of this procedure the TOF.W can be maintained in a standby state with a low flow of Nitrogen or the operator can continue on and purge with R134A+5% isobutane Mixture.

In addition to the Operating Procedures this document specifies the Local Emergency Plan of the TOF.W. This Local Emergency Plan will ensure:

- 1.1 The safety of all personnel from risks associated with the operation of the TOF.W gas system
- 1.2 The implementation of the appropriate emergency procedures
- 1.3 Prompt notification of the appropriate C-A and S&EP specialists
- 1.4 The maintenance of appropriate C-A emergency status
- 1.5 The preservation and protection of the environment
- 1.6 The preservation of BNL facilities and equipment

## **2.0 Responsibilities –**

During PHENIX operations, there will be two levels of responsibility for the oversight of the TOF.W gas systems: the PHENIX shift crew and the GAS experts.

The first level of responsibility resides with the PHENIX Shift Crew. During any period when the TOF.W has flammable gas flowing or HV on, there will be a minimum of two people on continuous shift in the PHENIX counting house. Once data taking starts, the number of people on shift at PHENIX will increase to five. The second level of responsibility resides with the TOF.W gas experts. The gas experts will be on-call to respond to any alarm or unusual occurrence detected by the PHENIX shift crew. A record of the performance of the TOF.W gas system will be maintained and monitored by the gas system experts and shift crew. During watch shifts or data taking, it will be the responsibility of the PHENIX Shift Crew to:

### **2.1 Monitor the status and alarms for the gas system.**

**2.2 In the event of an alarm or unusual occurrence, contact an expert from the Expert Call List.**

The second level of responsibility is the gas experts. It is the responsibility of the Gas experts to:

**2.3 Maintain the TOF.W Gas System in a safe operating condition. This includes:**

- 2.3.1 Changing gas cylinders and dewars when required
- 2.3.2 Setting, adjusting, and checking the gas mixture, flow rates and pressures.
- 2.3.3 Checking the certification of the operating gas (see details in Precautions, Section 4)
- 2.3.4 Posting any special instructions or notifications as required
- 2.3.5 Carrying out any emergency actions, as prescribed in the Procedures section of this document.

See Attachment 2 for additional information

**3.0 Prerequisites**

The TOF.W Gas Expert shall have read or have training in the following areas:

- 3.1 PHENIX Local Emergency Plan, RHIC-OPM 3.16,
- 3.2 BNL Compressed Gas Safety Training Course,
- 3.3 BNL Electrical Safety I
- 3.4 RHIC/PHENIX access training
- 3.5 BNL Haz-com
- 3.6 BNL General Employee Training

**4.0 Precautions**

The safety of personnel is of primary importance. The TOF.W Gas experts shall take great care to ensure that the TOF.W Gas Systems will be operated in a way that does not place personnel or equipment at risk of physical harm.

**4.1 Gas System Precautions:**

- 4.1.1 All gas cylinder storage is on the PHENIX Gas pad located just south and east of Building 1008 F, the PHENIX Gas Mixing Hut. All gas cylinders and dewars are to be changed by *authorized* PHENIX personnel with current BNL Compressed Gas Safety Training.

- 4.1.2 All valves and controls associated with the TOF.W Gas system are to be operated ONLY by **authorized** gas system experts with current training.
- 4.1.3 Primary care should be given to monitoring the internal pressure of the TOF.W throughout the duration of the start-up procedure, especially when adjusting flow rates. Over-pressurization of the TOF.W (above 3" WC) can result in structural damage to the detector.
- 4.1.4 **Before any HV can be turned on, sufficient operating gas must have flowed through each of the detectors for 4 volume exchanges. The total gas volume of all TOF.W detectors on the West carriage is 225 liters. The TOF.W HV is to be turned on only by a TOF.W HV expert with current training.**
- 4.1.5 Any reconfiguration or adjustment to the TOF.E Gas System in the PHENIX IR or mixing house is to be performed ONLY by an **authorized** TOF.W Gas System expert with current training.

## **5 Emergency Procedures**

### **5.1 In the event of a fire or emergency in Building 1008, members of the PHENIX Shift Crew shall (in order of priority)**

- 5.1.1 Follow emergency procedures described in C-A OPM 3.16 for the PHENIX area.

## **Starting the PHENIX TOF Gas System and Purging the TOF.W with dry Nitrogen**

### **6 Procedure**

#### **6.1 Power on the Gas System**

6.1.1 Turn on electronics rack and boot TOF.W PC

**NOTE 1. All solenoid valves, mass flow controllers and compressors are controlled with the gas system PC.**

6.1.2 Turn on AC power for Oxygen and H<sub>2</sub>O analyzers, FM1 and FM2 power Supply ( Electronic Rack)

#### **4.2 Prepare for Nitrogen Flow**

4.2.1 Confirm that FI1, FI7 and MV1 are closed.

4.2.2 Confirm that MBV1 is closed

4.2.3 Confirm that Nitrogen is connected to R134A supply line.

4.2.4 Set Nitrogen pressure 15 PSIG and confirm it on PI1

#### **4.3 Flow Nitrogen**

4.3.1 Confirm that SV8 is opened

4.3.2 Slowly open FI1 and set flow 1.0LPM.

4.3.3 Confirm flow on FI8

4.3.4 Check TOF.W pressure PT8, PT9, PT10, PT11 on PC.

4.3.5 Open SV4

4.3.6 Set FI3 and FI4 flows to 100CCM

**NOTE At this point, there are two options. Either maintain TOF.W in a standby mode with dry Nitrogen or continue on and prepare to flow R134A+5% isobutane Mixture.**

### **Operating the PHENIX TOF Gas System with R134A+5%isobutane Mixture**

## **7.0     Purpose and Scope**

The scope of this procedure is to operate the PHENIX Time of Flight(TOF) with R134A+5%isobutane Mixture using the TOF gas system. Operations in this part of the procedures include the following:

1. Purging the TOF.W with R134A+5%isobutane Mixture.
2. Running the system with the R134A+5%isobutane Mixture in recirculation for long term running.

In the operation described here R134A gas is routed from the gas storage area inside the Mixing House (MH) to TOF.W Gas Rack. Isobutane gas is routed to Gas Rack from gas storage outside MH (Isobutane Shed). For long term operation, the gas is frictionally recirculated. A portion of the gas is vented to atmosphere outside the mixing room while an equal amount of fresh of gas is introduced. Critical pressures and flows of the gas system are monitored by custom computer software.

The primary purpose of this operation is to initiate and maintain R134A+5%isobutane Mixture in the TOF.W with low levels of oxygen and water ( <100 ppm) for the duration of the PHENIX operations.

*(Note: After approval by CAD ESRC, The gas system described above may include the addition of 5% SF6 so that the mixture becomes 90% R134A, 5% isobutane and 5% SF6.)*

## **8.0     Procedure**

### **8.1     Initial Setup**

**NOTE            The following procedure assumes that the TOF.W have been flushed with Nitrogen and that auxiliary system have been turned on.**

8.1.1 Connect R134A Gas instead of Nitrogen to the gas system.

8.1.2 Set FI1 flow to 2LPM

8.1.3 Flash 3 TOF.W volumes with R134A.

8.1.4 Set PI2 pressure to 15PSIG

8.1.5 Open SV3

8.1.6 Close SV1



8.1.7 Set FM1 and FM2 to 1800CCM of R134A+5%isobutane Mixture flow and confirm on PC mixture content

**NOTE**     *The isobutane mass flow controller (FM2) is slaved to the R134A mass flow controller (FM1). Increasing the R134A flow will automatically increase the isobutane flow, maintaining the 95:5 ratio.*

8.1.8 Flash 2 TOF.W volumes with R134A +5%isobutane Mixture

8.1.9 Open MBV1

8.1.10 Open SV6

8.1.11 Open SV7

8.1.12 Purge Purifier/Dryer for 10 minutes

8.1.13 Close SV6

8.1.14 Turn On TIC1

**NOTE** At this point the gas system is ready for the recirculation mode.

## **9.0 R134A +5% Isobutane Mixture Recirculation**

9.1 Set FM1 to 200CCM flow

9.2 Close SV8

9.3 Open Valve on air supply line to PID Controller

9.4 Open MV1

9.5 Start Compressor at 1”WC pressure PT5

9.6 Set PID Controller set point to 0.8”WC

9.7 Set FI3 and FI4 flows to 300CCM

9.8 Using MBV1 and BPCV1 set PI3 pressure to 70”WC

9.9 Using MBV1 set PIS1 pressure to 0.8”WC

9.10 Using PCV1 set flow through FI3 to 1.5LPM

9.11 In the gas system control program, push the “disable alarms” button

**NOTE:** Use MV1 and FI7 to direct the flow through Purifier/Dryer.

## **9.1 Stopping of Recirculation Mode and purging with Nitrogen**

9.1.1 In the gas system control program, push the “enable alarms” button

9.1.2 Connect Nitrogen instead of R134A to the gas system.

9.1.3 Close SV3

9.1.4 Open SV8

9.1.5 Stop running Compressor

9.1.6 Open SV1

9.1.7 Set FI1 flow to 1LPM

9.1.8 Set FM1 flow to 0CCM

9.1.9 Close MV1

9.1.10 Close SV7

9.1.11 Turn off TIC1

9.1.12 Set FI3 and FI4 flows to 100CCM

9.1.13 Close SV6

9.1.14 Close isobutane supply line

9.1.15 Close Valve air supply line to PID Controller

## **10.0 Documentation**

- 10.1 All notes and observations should be recorded in the PHENIX gas system checklist. A gas system log sheet should be completed by the shift crew every 4 hours and entered into the gas checklist online database.

## **11.0 Attachments**

- 11.1 TOF Gas System Acronym Glossary
- 11.2 Responsible People/Operators
- 11.3 TOF.W gas system drawing

Attachment 1

TOF GAS SYSTEM ACRONYM GLOSSARY

BPCV	Back pressure control valve
CV	Check valve
F	Filter
FI	Flow indicator
FM	Mass flow controller
MV	Manual valve
PCV	Pressure control valve
PI	Pressure indicator
PT	Pressure transmitter
SV	Solenoid valve
T	Temperature transmitter
H	Heater
MBV	Manual Bypass Valve

Attachment 2: Responsible People/Operators

**Contact Information**

Contact Information for experts for this subsystem can be found on the PHENIX Internal Website in the [RUN] link at: (NOTE: replace ## by the current run number)

**[https://www.phenix.bnl.gov/WWW/run/##/contacts/subsys\\_experts.html](https://www.phenix.bnl.gov/WWW/run/##/contacts/subsys_experts.html)**

General PHENIX contact info can similarly be found at:

**<https://www.phenix.bnl.gov/WWW/run/##/contacts/>**

Gas system experts can be found at:

**[http://phenix.bnl.gov/WWW/tracking/gas\\_system/people.html](http://phenix.bnl.gov/WWW/tracking/gas_system/people.html)**

In addition, the Run Coordinator and Shift leader for the current run shall have a paper copy available of the contact information for the appropriate systems experts for this and all other PHENIX subsystems.

Attachment 3: Gas System Drawing (Reference: latest version of PHENIX controlled drawing #105-0208-002)

